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Specification and Drawings, as originally filed, with Application for Patent Serial  
No: 2,444,096, on October 1, 2003, by MANFRED A. LUPKE AND STEFAN A.  
LUPKE, for "Externally Cooled Moving Mold".

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ABSTRACT OF THE DISCLOSURE

A molding apparatus includes a moving mold for shaping molten plastic into product made within the 5 moving mold. The moving mold is surrounded by an air block housing to define a cooling chamber exteriorly around the moving mold. At least one heat exchanger is located within the cooling chamber. The heat exchanger provides cooling air which is contained by the housing 10 within the cooling chamber to act on and provide cooling of the moving mold.

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EXTERNALLY COOLED MOVING MOLD

FIELD OF THE INVENTION

The present invention relates to product molding  
5 apparatus of the type using mold block sections to form a  
moving mold.

BACKGROUND OF THE INVENTION

It is known in the molding business and  
10 particularly in the pipe molding business to use moving  
molds in forming the pipe for product. These moving  
molds are formed by mold block sections that mate with  
one another to define a mold block tunnel. Molten  
plastic is fed from an extruder into the moving mold  
15 tunnel. The mold block sections then separate from one  
another along what is known as a return run to move back  
to an up stream position for reentering the moving mold.  
The plastic product or pipe emerges from the downstream  
20 end of the moving mold where the mold block sections  
separate from one another before moving to their return  
path.

As the mold block sections move in a downstream  
direction in the moving mold tunnel they pick up a large  
25 amount of heat from the molten plastic. This is  
detrimental to the cooling and shaping of the product in  
the moving mold. As such, it is important to attempt as  
much as possible to cool the mold block sections.  
Typically, this is done while the mold block sections are  
30 mated with one another through the moving mold by  
subjecting them to different cooling mediums. One  
cooling medium according to conventional practice may be  
in the form of chilled water run through or onto the  
surfaces of the mold block sections. Another cooling  
35 medium is cooling air run through the mold tunnel.

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In the case where water is used to cool the mold block sections there are generally problems created in controlling and drawing the water flow

5 In the case of introducing cooling air directly into the mold tunnel there are problems associated with the location for the introduction of the air to get it into the mold tunnel. Further there is a problem with cooling of the actual extrusion equipment through which  
10 the air is passed to get the air into the interior of the mold tunnel.

SUMMARY OF THE PRESENT INVENTION

15 The present invention provides a molding apparatus having a moving mold which is subjected to cooling air outwardly around the moving mold. This eliminates the problems described above.

20 More particularly, the molding apparatus of the present invention includes a moving mold for shaping molten plastic into product made within the moving mold. The moving mold is surrounded by an air block housing to define a cooling chamber exteriorly around the moving mold. A source of cooling air provides the cooling  
25 medium which is contained by the housing within the cooling chamber to act on and provide cooling of the moving mold.

BRIEF DESCRIPTION OF THE DRAWINGS

30 The above as well as other advantages and features of the present invention will be described in greater detail according to the preferred embodiments of the present invention in which;

35 Figure 1 is a side view of a complete molding apparatus according to a preferred embodiment of the

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present invention;

Figure 2 is a sectional view through the moving mold region of the apparatus of Figure 1;

5           Figure 3 is an enlarged sectional view through the  
upstream end of the moving mold region of Figure 1.

DETAILED DESCRIPTION ACCORDING TO THE PREFERRED EMBODIMENTS OF THE PRESENT INVENTION IN WHICH:

10 Figure 1 shows a pipe forming apparatus generally indicated at 1. The entirety of this apparatus includes extrusion equipment 3 at the upstream end of the apparatus. This extrusion equipment provides molten plastic which is fed to a molding region generally indicated at 5. Plastic product and in this case plastic pipe is shaped from the molten plastic within the molding region. The plastic pipe then leaves the molding region for further setting or hardening within a cooler 17 located downstream of the molding region 5.

The molding region itself comprises a pair of endless tracks of mold block sections 7 and 9. These mold block sections as better seen in Figure 2 of the drawings meet to form a moving mold having a mold tunnel 10. The mold block sections then separate from one another along a return run before reentering the moving mold tunnel. In Figure 2, mold block sections 7a from the upper track 7 mate with mold block sections 9a from the lower track 9 in forming the moving mold tunnel. Figure 2 also shows mold block sections 7b from the upper track and mold block sections 9b from the lower track in their open configuration as they move along their respective return paths.

35

Figure 3 of the drawings shows that the die

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equipment includes die tooling 4 which feeds the molten plastic into the moving mold tunnel 10 where the plastic is actually shaped or formed into a pipe body.

5        Returning to Figure 2 of the drawings, it will be seen that the moving mold comprising both the forward run and the return run for each of the tracks 7 and 9 is surrounded by an air block housing 11. This air block housing as described later in detail defines a cooling 10 chamber 13 exteriorly around the moving mold.

15        Cooling chamber 13 contains cooling air which is trapped within the cooling chamber to act on the exterior surfaces of the mold block sections as they move through mold tunnel 10. The same trapped air also acts on the interior surfaces of the mold block sections when the mold block sections are in an open configuration along a return run to the moving mold tunnel. More specifically, 20 the cooling air acts on the exterior surfaces of mold block sections 7a and 9a and also acts on both the interior and the exterior surfaces of mold block sections 7b and 9b.

25        The cooling air can come from a number of different sources. These sources can be located either externally or internally of the air block housing. When the source of cooling is located externally of the housing it must be moved into the housing by air supply means such as ducting 15 shown in Figures 1 and 2.

30        The source of cooling air can either be a manufactured source of air or it can be ambient air when the apparatus is situated in a relatively cold weather climate. A blower could be used to move the air through 35 the ducting from the supply source into the housing.

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According to a preferred embodiment of the invention as shown in Figure 2 of the drawings air cooling units are provided directly within chamber 13 surrounded by housing 11. The housing is preferably 5 insulated to prevent heat loss through the housing.

The cooling units such as heat exchangers 21 may for example be located to either side of the moving mold tunnel. Blowers 23 help to produce a heat exchange 10 between the cooling units and the exterior surface of the moving mold tunnel. Further cooling units such as heat exchangers 25 with associated blowers 27 may be provided above and below the open mold block sections 7b and 9b along their return runs.

15 The above heat exchangers comprise any of numerous different types of refrigeration units to chill the air within the cooling chamber. This chilled air is then moved onto the various different surfaces of the mold 20 block sections. The heated air coming off the mold block sections is in turn cooled by the heat exchangers. The air movement or turbulence within cooling chamber 13 enhances the cooling effect of the chilling or cooling 25 air. This air is not allowed to escape the immediate vicinity of the mold block sections by virtue of it being entrapped within the air block housing 11.

As earlier described, die tooling 4 feeds to the mold tunnel 10. It enters the cooling chamber through 30 mouth 12 of housing 11. This mouth closely surrounds the die tooling to inhibit as much as possible the escape of cold air from chamber 13.

As will be appreciated from the description 35 immediately above, die tooling 4 is itself exposed to the cooling air within chamber 13. However, cooling of the

die tooling is adverse to the operation of the extruder. As such, a heater 31 having a plenum 33 feeds hot air directly onto the exterior surface of die tooling 4 where the die tooling enters chamber 11. This hot air heating 5 of the die tooling offsets the effect of the cooling air within the chamber on the die tooling.

The plastic pipe which leaves the molding region 5 of the apparatus will be in a much firmer or more setup 10 condition than it would be with a conventional moving mold. This is because the mold sections themselves are kept much cooler than is normal practice. As such the mold block sections are able to much more easily absorb 15 the heat from the plastic for the setting of the shape of the pipe in the molding region.

Figure 1 as noted above also shows a product cooler 17 located inline with and downstream of mold tunnel 10. If this cooler is needed it provides 20 additional setting of the pipe outside of the mold region. In accordance with a preferred embodiment of the invention cooler 17 is set up in a manner very similar to the actual mold region in that it may be provided with its own supply of cooling air contained within the 25 housing of cooler 17. This cooling air is then trapped outwardly around and acts directly on the plastic of the pipe. This therefore provides an extremely rapid means for final cooling the pipe.

30 The drawings show the apparatus and in particular the moving mold as operating in a horizontal direction. The invention i.e., the surrounding of the moving mold by an air block housing which contains cooling air is 35 equally applicable to a plastic product forming apparatus having a vertically orientated moving mold.

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Although various preferred embodiments of the present invention have been described in detail, it will be appreciated by those skilled in the art that variations may be made without departing from the spirit 5 of the invention or the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A molding apparatus including a moving mold for shaping molten plastic into product made within said moving mold, said moving mold being surrounded by an air block housing to define a cooling chamber exteriorly around said moving mold, a source of cooling air, the cooling air being contained by said housing within said cooling chamber to act on and provide cooling of said moving mold.  
5
2. Apparatus as claimed in Claim 1 wherein the source of cooling air comprises at least one cooling air unit.  
15
3. Apparatus as claimed in Claim 2 wherein said cooling unit is located internally of said air block housing.  
20
4. Molding apparatus as claimed in Claim 3 including at least one blower for circulating the cooled air within said cooling chamber.  
25
5. Apparatus as claimed in Claim 2 wherein said cooling unit is located externally of said air block housing, said apparatus including ducting from said unit to said air block housing and a blower for moving the cooled air from said cooling unit through said ducting into air housing.  
30
6. Molding apparatus as claimed in Claim 1 wherein said source of cooling air comprises cooled ambient air externally of said cooling chamber, said apparatus including ducting from said housing to the source of cooling air.  
35

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7. Molding apparatus as claimed in Claim 6 including blower means to move the cooling air from said source through said ducting into said cooling chamber.

5 8. Apparatus as claimed in Claim 1 wherein said air block housing is insulated to minimize heat loss of the cooling air through said housing.

10 9. Apparatus as claimed in Claim 8 including access doors through said housing to said moving mold, said access doors also being insulated.

10. Apparatus as claimed in Claim 9 including alarms which indicate opening of said access doors.

15 11. Apparatus as claimed in Claim 1 including extruder die tooling feeding into said moving mold at one end of said housing and further including a heater for heating said die tooling to offset effect of the cooling air in 20 said cooling chamber on the die tooling.

12. Apparatus as claimed in Claim 1 wherein said moving mold comprises a pipe corrugator.

25 13. Apparatus as claimed in Claim 1 wherein said moving mold travels in a vertical direction through said cooling chamber.

30 14. Apparatus as claimed in Claim 1 wherein said moving mold travels in a horizontal direction through said cooling chamber.

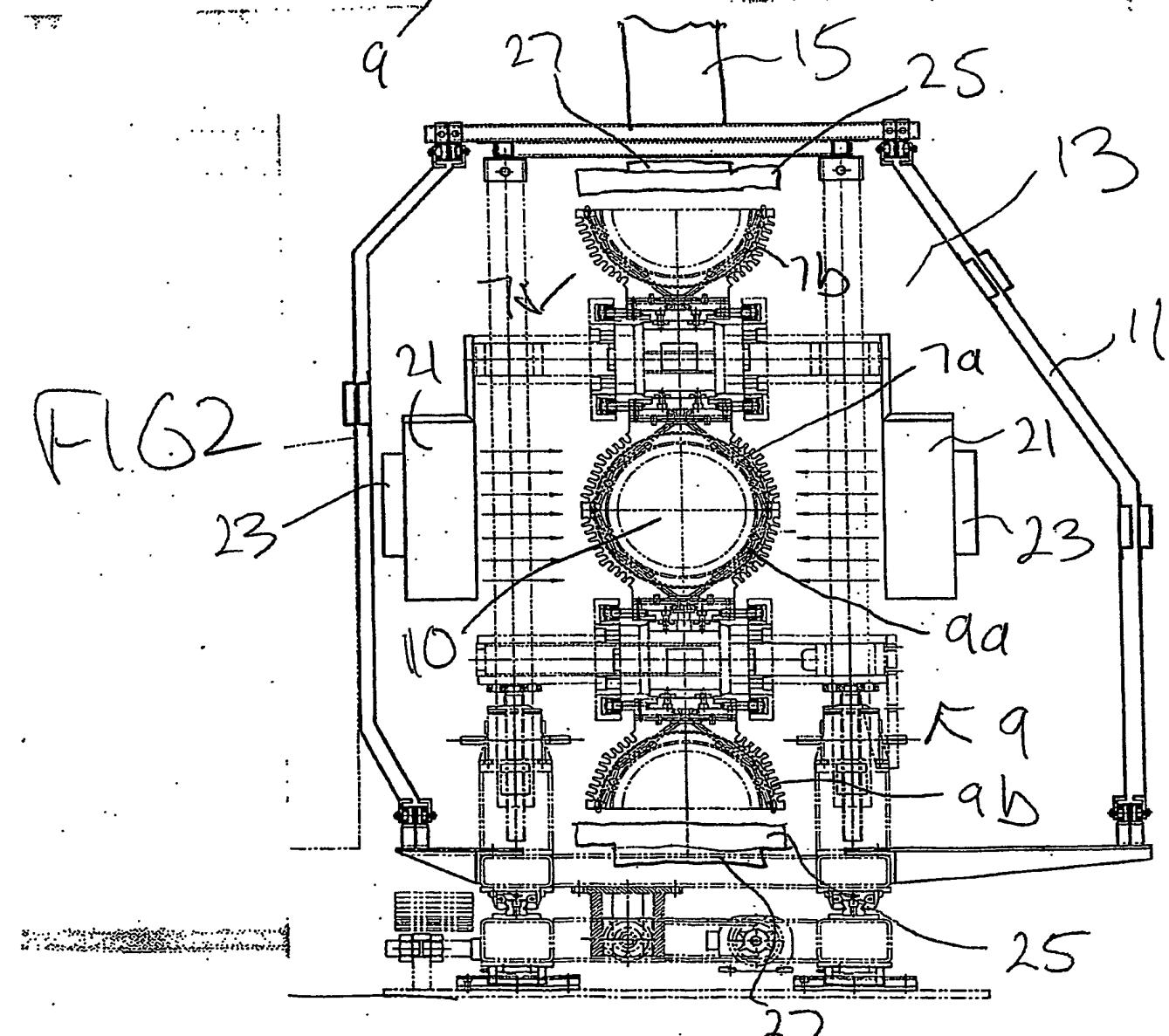
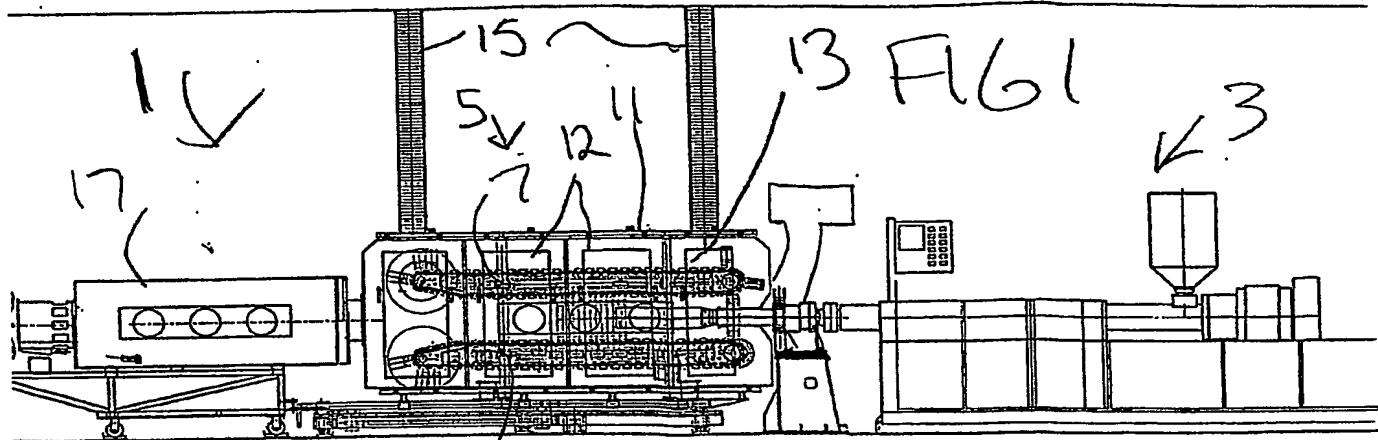
35 15. Apparatus as claimed in Claim 1 including a product cooler downstream of said air block housing, said product cooler being inline with and receiving the plastic product from said moving mold and comprising a

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cooler housing around the product, and a heat exchanger within said cooler housing, said heat exchanger in said cooler housing providing cooled air which is trapped within the cooler housing to act on the product after the 5 product is released from the moving mold.

16. Apparatus as claimed in Claim 1 including a plurality of heat exchangers located within said cooling chamber, said plurality of heat exchangers including 10 first and second heat exchangers located to opposite sides of said moving mold.

17. Apparatus as claimed in Claim 1 wherein said moving mold comprises mold block sections which move in a downstream direction through said cooling chamber in a 15 closed mold block configuration and which move upstream of said cooling chamber in an open mold block section configuration, said apparatus including first and second heat exchangers located to first and second sides of said 20 moving mold and directed at said mold block sections in the closed mold block configuration, and further including third and fourth heat exchangers to third and fourth sides of said moving mold and directed at said 25 mold block sections in the open mold block section configuration.



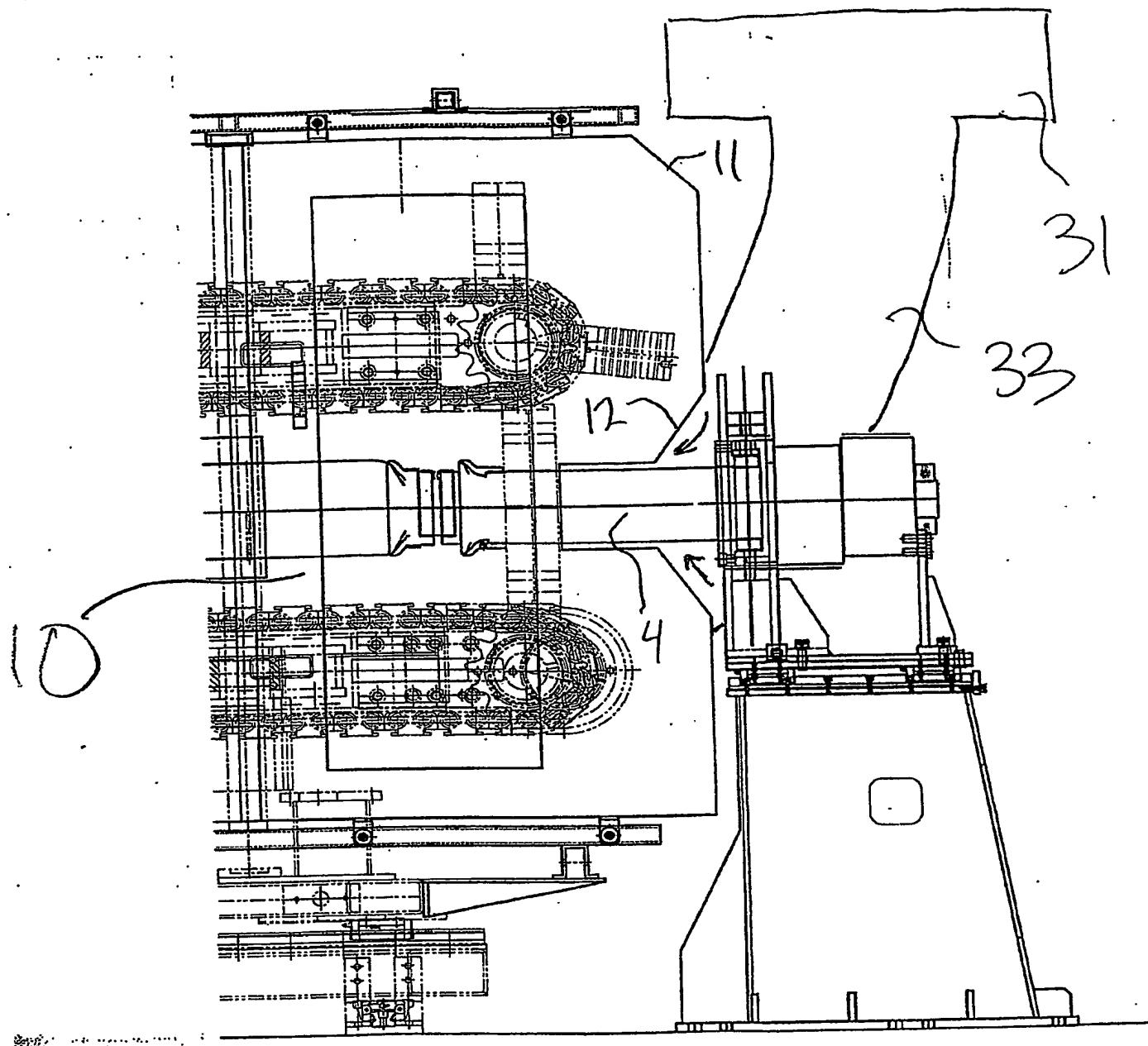


FIG3

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